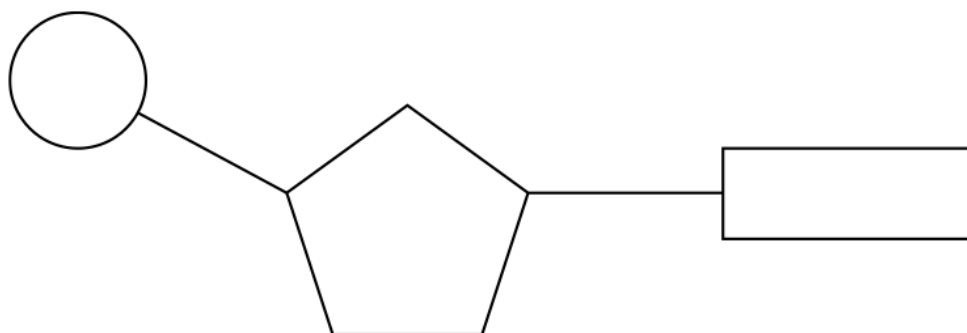


1.

The diagram below shows a simple nucleotide.



(a) On the diagram above, draw a circle around the component that contains nitrogen. [1]

(b) Describe **two** differences between a DNA nucleotide and an RNA nucleotide. [2]

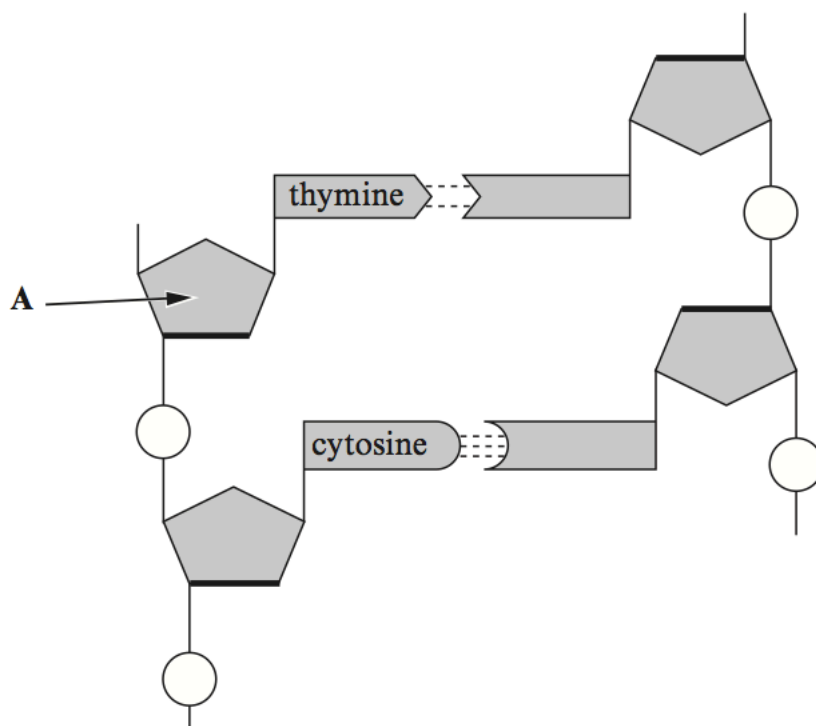
An experiment was carried out to determine the relative percentages of the bases in DNA from various organisms. The results are shown in the table below.

Source of DNA	Relative percentage of base in sample			
	Adenine	Guanine	Thymine	Cytosine
human	30.9	19.9	29.4	19.8
sea urchin	32.8	17.7	32.1	17.3
wheat	27.3	22.7	27.1	22.8

(c) DNA is a double stranded molecule. Explain how the data in the table supports the concept of complementary base pairing. [2]

2.

The diagram represents the molecular structure of part of a DNA molecule.



- (a) Name part A. [1]

.....

- (b) Part of a DNA molecule has the following sequence of bases.

T-A-T-C-G

- (i) In the table below write the letters for the sequence of bases of the complementary portion of DNA. [1]

DNA molecule	T	A	T	C	G
complementary DNA					

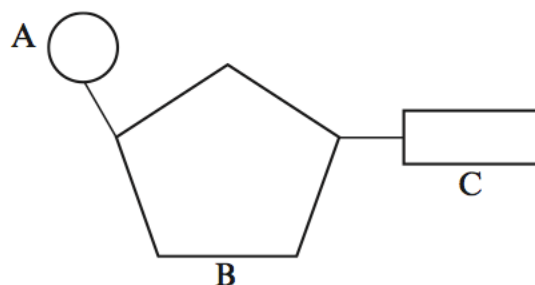
- (ii) Biochemical analysis of a sample of DNA showed that 30% of the bases were guanine.
Calculate the percentage of the bases in the sample which would be adenine.
Show your working. [2]

Answer

(Total 4 marks)

3.

(a) The diagram below shows a unit which makes up nucleic acids.



(i) Name the structural unit shown. [1]

.....

(ii) Name component A. [1]

.....

(iii) Name component B in DNA and RNA. [1]

DNA

RNA

(iv) Name the **four** components found in DNA, represented by C. [2]

.....
.....

(b) Describe how the structural units, drawn in part (a), are arranged in DNA molecules. [4]

.....
.....
.....
.....
.....
.....

(c) Describe the function of DNA molecules in cells. [1]

.....
.....

(Total 10 marks)

4.

- (a) Complete the table below which compares DNA with messenger RNA (mRNA). [4]

<i>Feature</i>	<i>DNA</i>	<i>mRNA</i>
Name of sugar		
Number of carbon atoms in sugar		
Number of polynucleotide chains in molecule		
Location in cell		

- (b) The table below shows the relative amounts of the four bases in DNA taken from three sources.

<i>Cellular source of DNA</i>	<i>Nitrogenous base (relative amounts)</i>			
	<i>Adenine</i>	<i>Guanine</i>	<i>Cytosine</i>	<i>Thymine</i>
rat muscle	28.6	21.4	21.5	28.4
wheat seed	27.3	22.7	22.9	27.1
yeast	31.3	18.7	17.1	32.9

- (i) Explain why the relative amount of adenine is almost the same as the relative amount of thymine in **each** source. [3]

.....

.....

.....

- (ii) Explain why the base sequence of the DNA samples taken from a rat's bone marrow would be the same as those taken from the muscle of the **same** rat. [3]

.....

.....

.....

.....

- (iii) Explain how a sample of DNA from a rat sperm cell differs from that of a muscle cell from the **same** rat. [3]

.....

.....

.....

.....

(Total 13 marks)

5.

Two types of nucleic acid, DNA and RNA are found in cells. Statements in the table, may apply to DNA, RNA or both. Complete the table by putting a tick (✓) if the statement is true or a cross (✗) if the statement is not true. [6]

	<i>DNA</i>	<i>RNA</i>
Contains a pentose sugar		
Found in the nucleus		
Thymine is never present		
Consists of a double helix		
Molecules short lived		
Associated with ribosomes		

(Total 6 marks)

6. (a) (i) Draw a simple **labelled** diagram to show how the three parts of a nucleotide are arranged. [3]

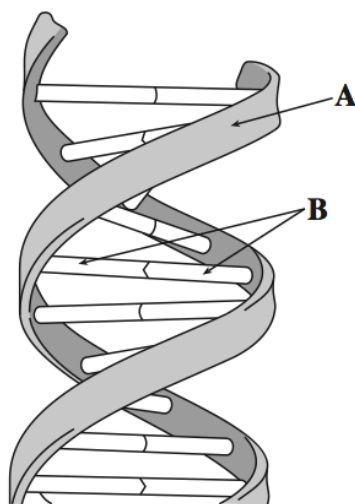
- (ii) How do nucleotides of RNA differ from nucleotides of DNA? [2]

.....

.....

.....

- (b) The DNA molecule is a double helix. It may be described as a coiled ladder.



- (i) What are the 'uprights' of the ladder, labelled **A**, made of? [1]

.....

- (ii) The 'rungs' are made by the pairing of components labelled **B**. Name the components in their complementary pairs. [2]

.....

.....

- (iii) Name the type of bonds that hold the pairs together. [1]

.....

(Total 9 marks)

7.

5. (a) In the table below, give **three** differences between the structures of DNA and RNA. [3]

	DNA	RNA
1.	<div></div> <div></div> <div></div>	<div></div> <div></div> <div></div>
2.	<div></div> <div></div> <div></div>	<div></div> <div></div> <div></div>
3.	<div></div> <div></div> <div></div>	<div></div> <div></div> <div></div>

8.

Until recently it was believed that there were three different types of RNA found within cells. Ten years ago a fourth type of RNA was discovered in the cytoplasm, small interfering RNA or guide RNA.

These RNA molecules are between 20-25 nucleotides long and they are double stranded.

There is considerable excitement about this in the scientific world as this type of RNA interferes with protein synthesis and synthetic small interfering RNA molecules could in the future be used to treat viral diseases such as HIV and hepatitis.

- (a) (i) Complete the following list of the types of RNA found within cells. [2]
 Messenger RNA.
 Small interfering RNA (guide RNA)

.....

.....

- (ii) Give **one similarity** and **three differences** between small interfering RNA and DNA. [4]

Similarity

Differences

1

.....

2

.....

3

.....

- (b) (i) If a sample of **DNA** contains 50% purine bases what would be the percentage of pyrimidine bases in the sample? [1]

.....

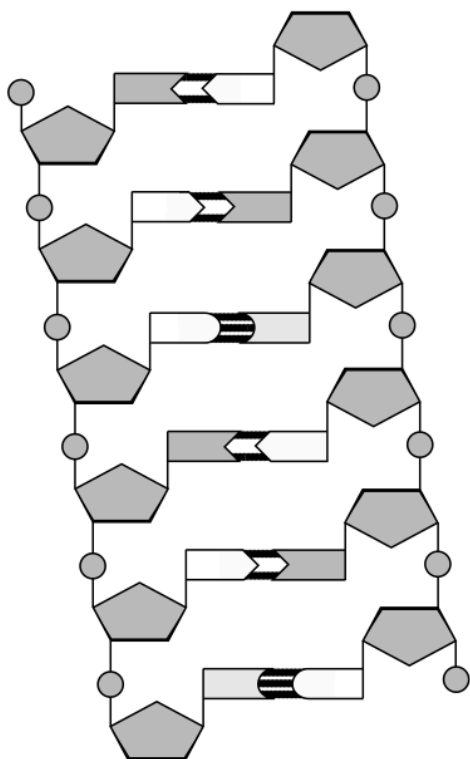
- (ii) Of the 50% purine bases, 10% was Adenine. Complete the table showing the percentage of the other nucleotides. [3]

<i>Nucleotide</i>	<i>Percentage (%)</i>
Adenine	10

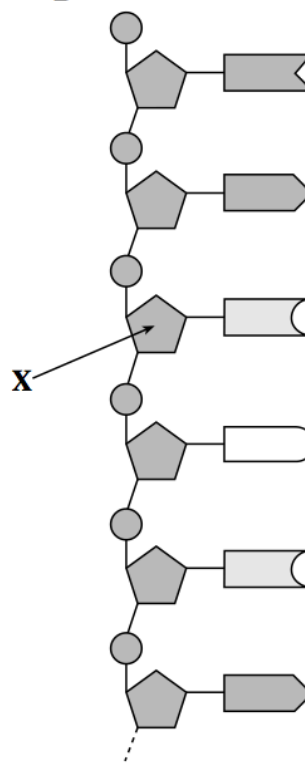
9.

The diagrams below represent two biological molecules.

A



B



(a) (i) Name molecules **A** and **B**. [1]

A

B

(ii) Name **X**. [1]

.....

(iii) Where in the cell would you find molecule **A**? [1]

.....

(iv) Name the bond that holds the two strands together in **A**. [1]

.....

(v) Give **one other** structural difference, not illustrated in the diagram, between the two molecules **A** and **B**. [1]

.....

.....

- (b) Erwin Chargaff recognised that there were four types of bases in the nucleic acid found in the nucleus. The table below shows the results of his experimental work.

<i>Source of nuclear material</i>	<i>% adenine</i>	<i>% guanine</i>	<i>% cytosine</i>	<i>% thymine</i>
wheat	27.3	22.7	22.8	27.1
broad bean	29.7	20.6	20.1	29.6
salmon	29.7	20.8	20.4	29.1
bull	28.6	22.2	22.0	27.2
human	30.9	19.9	19.8	29.4

Source: Chargaff, E. (et al.) 1953, *Nature*, London, no. 172, p.289

- (i) What conclusions did Chargaff draw from this data about the pairing of bases in the nucleic acids of various species? [1]

.....

.....

- (ii) Using the data from the table above, explain how he came to his conclusion. [1]

.....

.....

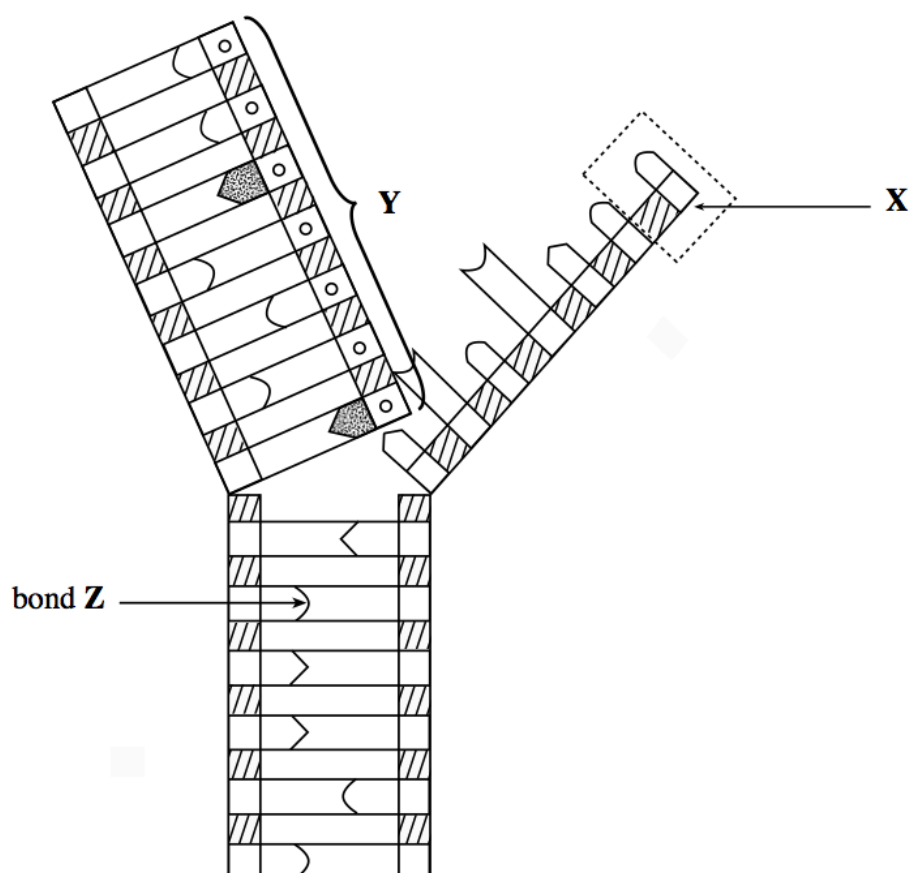
- (iii) What category of bases are adenine and guanine? [1]

.....

(Total 8 marks)

10.

The following diagram represents part of a DNA molecule and a mRNA molecule.



(a) The key for the diagram is shown below, as a table. Complete the table.

[4]

Symbol	Name of molecule
	Deoxyribose
	Phosphoric acid
	Ribose
Pyrimidine base 	Uracil
Pyrimidine base 	
Pyrimidine base 	
Purine base 	
Purine base 	

(b) (i) Name the subunit labelled **X**. [1]

.....

(ii) Give the names of the component molecules which make up this structure. [3]

.....

.....

.....

(c) Name bond **Z** as shown on the diagram. [1]

.....

(d) Condensation reactions are involved in the production of DNA. Give the name of **one pair** of molecules which are linked in such a way. [1]

.....

(e) Give **two** pieces of evidence from the diagram which indicate that the molecule **Y** is RNA and not half a strand of DNA. [2]

1

.....

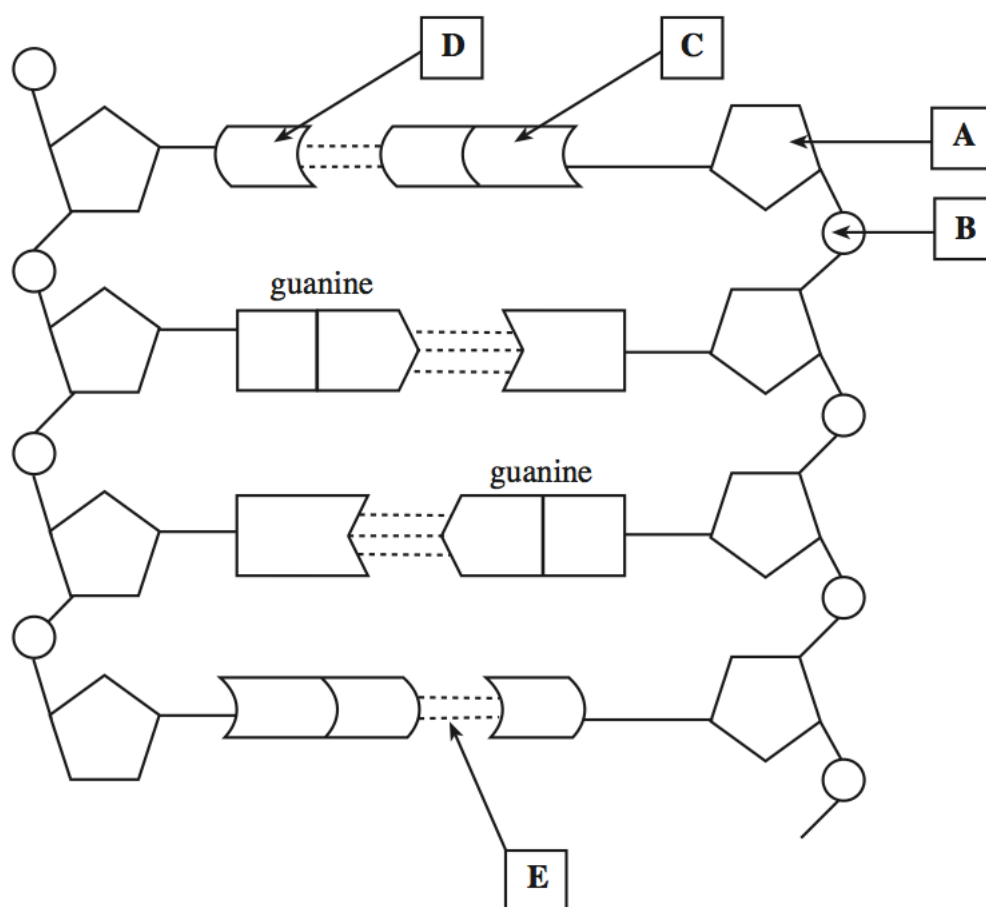
2

.....

(Total 12 marks)

11.

The diagram below shows a section of a DNA molecule.



(a) Name the parts labelled **A** and **B**. [2]

A

B

(b) What type of bonding is shown at **E**? [1]

.....

(c) (i) What type of nitrogenous base is guanine? [1]

.....

(ii) Name the bases **C** and **D**. [2]

C

D

(d) On the diagram above, draw a ring around a single nucleotide unit. [1]

- (e) A large sample of DNA was analysed and found to contain 28% of the nitrogenous base guanine. Calculate the percentage of the molecule that would be thymine.
You must show your working. [3]

.....

.....

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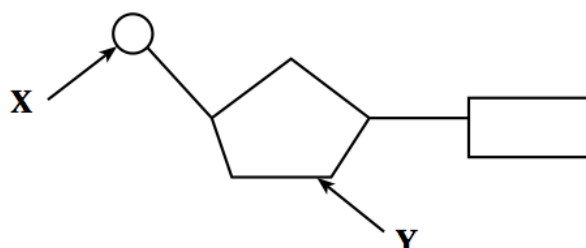
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(Total 10 marks)

12.

- (a) The diagram shows the structure of a DNA nucleotide.



Identify the parts of the nucleotide labelled **X** and **Y**. [2]

X

Y

- (b) The table shows the percentage composition of bases in DNA of cattle and octopus.

<i>Organism</i>	<i>Percentage composition</i>			
	<i>Adenine</i>	<i>Cytosine</i>	<i>Guanine</i>	<i>Thymine</i>
cattle	29		21	
octopus	33			33

- (i) Calculate the missing values and complete the table. [2]

- (ii) Explain how you used your knowledge of the structure of DNA to arrive at your answer in (i). [2]

.....

.....

.....

.....

.....

- (c) Describe **two** differences between the structure of DNA and RNA. [2]

.....

.....

.....

.....

Essays

1.
(b) Give an account of the structure and function of nucleic acids. [10]
2.
(b) Describe the structure of DNA. [10]
3.
(b) Describe the similarities and differences in the structure of amino acids and nucleotides. [10]
4.
(a) (i) Describe the structure of DNA. [7]
(ii) What are the differences between DNA and RNA? [3]